# Residual Seasonality in GDP and GDI Findings and Next Steps



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#### Overview



- Overview of current seasonal adjustment methodology for national income and product accounts:
  - Gross domestic product (GDP)
  - Gross domestic income (GDI)
- Test components and aggregates for residual seasonality
- Determine major causes of residual seasonality
- Discuss strategies for removing residual seasonality and improving seasonal adjustment methods

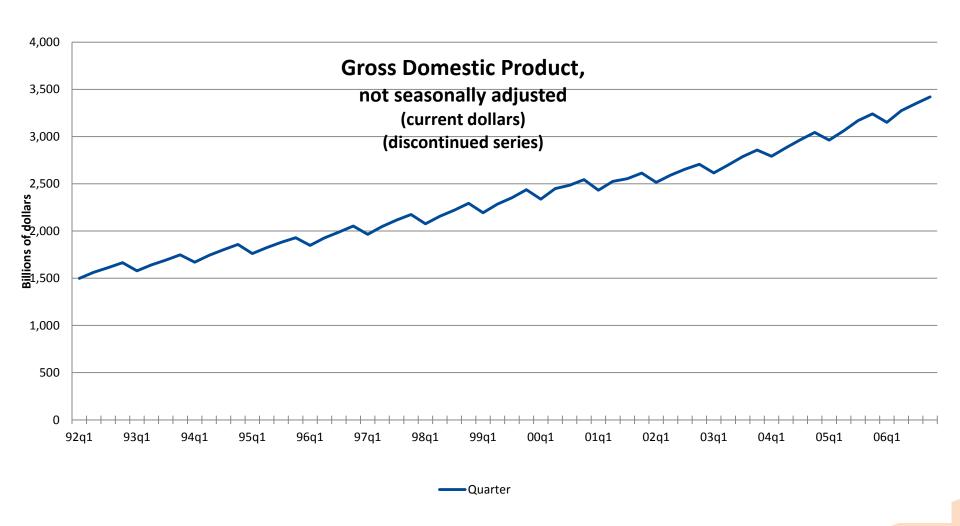
## Background



- U.S. national income and product accounts
  - Macroeconomic time series including GDP, GDI
  - Estimated from various source data
  - Compilation based on accounting framework
  - Annual estimates (since 1929)
  - Quarterly, seasonally adjusted estimates (since 1947)
  - Limited not seasonally adjusted (NSA) GDP estimates were formerly compiled separately, but project ended in 2008 due to budget cuts
- In early 2015, reports of residual seasonality in GDP related to weakness in first quarter growth

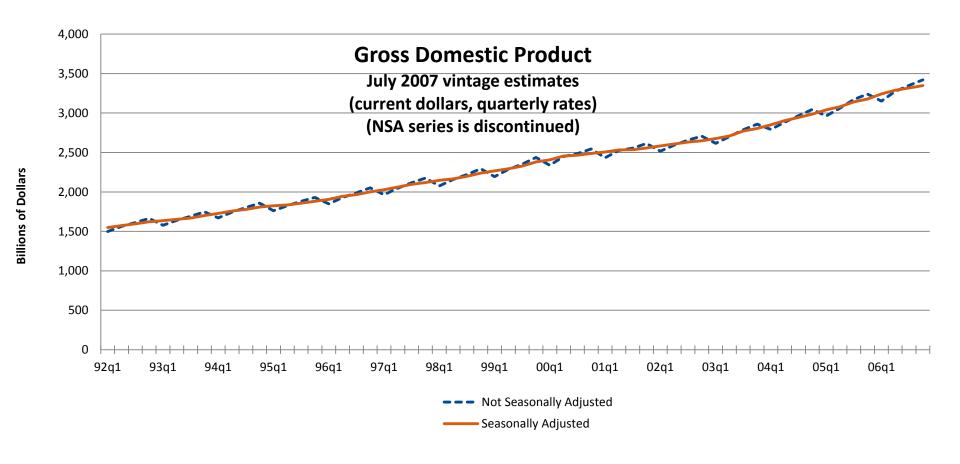
## Gross Domestic Product, NSA (discontinued)





# Gross Domestic Product, 1992-2006





## NIPA seasonal adjustment methodology



- Possible approaches: Direct versus Indirect
- Direct approach
  - Estimate not seasonally adjusted (NSA) components from NSA source data. Aggregate, then seasonally adjust aggregate GDP as final step
  - Problem difficult to explain seasonally adjusted GDP based on source data and components
- Indirect approach
  - Estimate seasonally adjusted (SA) components directly from SA source data, then aggregate
    - If source data are seasonally adjusted by source agency, retain its seasonal adjustments
    - Otherwise, source data seasonally adjusted by BEA staff
  - Problem potential residual seasonality
- BEA's long-standing practice is to use the indirect approach

## Component review



- Goal Identify and investigate causes of residual seasonality in order to propose solutions
- Methodology
  - Examined 2,000 GDP component data series for
    - Current dollars
    - Real (chained 2009 dollars)
    - Price indexes
  - Used X-12 ARIMA
    - F test for stable seasonality
    - M7 statistic
    - 10, 15, and 30 year periods

#### Results of tests



- Results sensitive to period selected
- Real GDP exhibited residual seasonality over 10-year and 30year spans
- Several real GDP components also exhibited residual seasonality over certain spans
  - Investment in nonresidential structures
  - Exports of goods
  - Federal government spending
  - State and local government spending
- GDP price index exhibited residual seasonality over 30-year span, as did several components
- GDI did not exhibit residual seasonality

# Causes of residual seasonality



Two main factors causing residual seasonality were identified:

- Use of monthly source data to estimate quarterly GDP components
  - Monthly series may not exhibit seasonality and isn't seasonally adjusted, but seasonal when aggregated to quarterly frequency
  - Or, data that are seasonally adjusted at monthly frequency may exhibit residual seasonality when aggregated to quarterly frequency
  - Solution involves examining series at both monthly and quarterly frequency

# Causes of residual seasonality



- Revisions to seasonal adjustment factors not shown consistently in time series due to revision practices that limit the number of years open to revision
  - Moving averages new data lead to revisions in seasonal factors for several years
  - BEA national income and product accounts traditionally revise most recent 3 years except for comprehensive (benchmark) updates
  - Some Census indicators only revise SA estimates for years with revised annual data
  - Solution involves changing revision practices to allow revisions to SA estimates for longer periods

## Causes of residual seasonality (minor)



Other, less common factors also contribute to residual seasonality for certain components:

- 3. By convention, certain series related to government policy haven't been seasonally adjusted (e.g. federal pay raises).
- 4. Residual seasonality may arise as a result of estimation processes, such as commodity flow, aggregation, or deflation, even when input series are seasonally adjusted.

These problems can be identified and corrected by modifying BEA estimation processes.

## Plan for addressing residual seasonality



- BEA has used findings of this review to modify seasonal adjustments for recent years
  - Began seasonally adjusting component series that previously hadn't been adjusted
    - Series within federal defense spending, consumer spending on services, inventory investment
  - Began modifying methodologies, for example to seasonally adjust certain series at quarterly frequency
  - Interagency seasonal adjustment team (with Census and BLS)
- For July 2018 comprehensive update, the historical time series will be revised to remove identifiable residual seasonality

#### Reintroduce NSA estimates



- Starting in 2018, BEA will begin producing and publishing NSA estimates of GDP and its major components.
- In contrast to old discontinued program, these NSA estimates will be
  - Released concurrently with quarterly GDP
  - Include estimates of real GDP and price indexes
- Will allow comparisons of direct and indirect approaches to seasonal adjustment